

Please Note:

The following document has been left in its original state and may contain outdated contact information.

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APPLICATION OF *Scorpius* LOW COST LAUNCH SERVICES TO MINI-LIFT MARKET



MSFC Industry Review

January 13-14, 1998



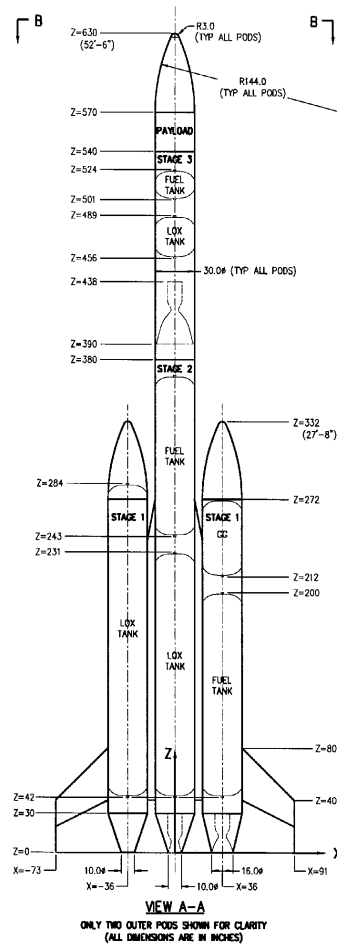
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Sprite Mini-Lift Expendable Booster



Payload - 150kg to 200 NM sun-synchronous circular orbit

- **3-stage; 39,000 lb GLOW; 52.5 ft high; 30 inch dia. fairing**
- **New GPS/INS based guidance, navigation and control**
- **New thrust termination system**
- **LOX/kerosene propellants**
- **Pressure-fed system with mixing gas generator**
- **TRW was major bidding subcontractor**
- **Scalable to 200kg lift**



Microcosm's Design for Low Cost Progress to Date

3

- **Multiple DT & E efforts with Microcosm internal IR & D, AFRL, BMDO and MSFC starting before 1992**
- **Propulsion**
 - **Demonstrated full duration 5,000 lb low cost ablative engine firings (recurring cost <\$5,000/chamber)**
 - **Multiple low-cost injectors in production and test**
 - **Mixing gas generator in development**
- **Avionics**
 - **GPS/INS based GN & C system (<\$15,000 in production)**
 - **Produced new flight computer and smart controller (<\$4,000)**
 - **Low Cost telemetry system (<\$10,000)**
- **Tanks**
 - **Sub-scale tanks built and successfully tested**
 - **Producing *Sprite* diameter tanks for current suborbital vehicle**
- **Facilities and Operation**
 - **Plans for low-cost assembly, transport, ground level servicing and launch (Kodiac, California Spaceport, Wallops) (<\$250,000 in launch operations)**

Note: \$ are unburdened cost in \$FY97 dollars



Proposed *Sprite* Schedule/Cost

<u>Month</u>	<u>Activity</u>
11	1 st test flt.stage 1 & 2
17	2 nd flt. 3 stages + shroud separation
23	3 rd flt. full orbit insertion and 3 rd stage de-orbit
28	1 st payload flight

<u>Cost Element</u>	<u>Projected Budget</u>
DT & E through 3 rd test flt.	\$21.9M
Range facility upgrade	\$2.8M
Range ops and support	\$2.3M
AFRL & MSFC task agreements	\$0.9M
Total DT & E	\$27.9M

1 st Payload Flight	\$2.3M
10 th Payload Flight	\$1.55M
Prices include range launch ops (\$0.45M for 10 th flight) but not insurance or DT&E amortization	

Not Awarded because:

- (1) Complexity of Pod clustering (horizontal rather than vertical configuration)
- (2) 3 stages rather than 2
- (3) NRA would be duplicative of prior and existing funding

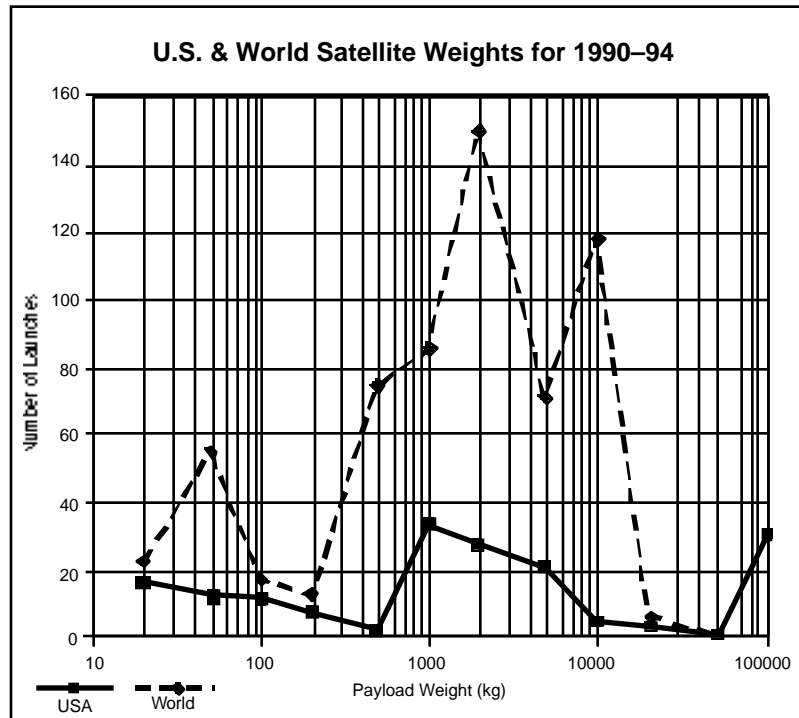
Microcosm's Low Cost Design Philosophy

- **Design at outset for minimum cost**
 - **Use COTS and industrial component whenever possible**
Avoid performance optimization and tight tolerances
 - **Design for manufacturing**
 - **Use composites for strength to weight/cost**
 - **Minimize use of different parts**
 - **Multiple stages allows robustness and lower mass fraction**
 - **Simplify the system**
 - **Improve reliability**
 - **Lower cost**
 - **Pressure-fed system for reduced cost**
 - **Minimize moving parts**

Scorpius Project Status

- **SR-S and SR-1 Suborbital Vehicles Completed CDR on October 16, 1997**
- **Current Launch Schedule: (White Sands WC-50)**
 - SR-S scheduled to start launch campaign March, 1998
 - SR-1 will start launch campaign 3rd Q 98
- **5k lb. engines have had multiple full duration firings and flight weight injector complete**
 - Substantial testing to continue to qualify engines and propulsion system
- **100k lb. Test Stand at RPTF Socorro, NM**
 - Buildup in progress; hot firings to start in 1st Q 98
 - 20k lb. Engine and injectors testing in 2nd Q 98
 - 40k lb. Testing in 2nd Q 98

Small Payload Market



- Existing US small payload market is small but world wide market is considerably larger
- From Wertz, *Reducing Space Mission Cost* (1997), the existing small payload requirements are centered on payloads of 50kg
- Planned constellations of small spacecraft show considerable growth in the 50 to 100kg size

Conclusion

- **Mini-lift capability feasible in CY 2000 for <\$2 M/launch (excluding DT & E cost amortization)**
- **Market size is difficult to determine**
 - Variety of new proposed systems
 - Shared rides/multi-manifest discounted prices
 - Existing US requirements dominated by NASA/USRA requirements
 - Potential 10-fold increase over today's launch rates if cost can be reduced
- **Financing a small payload launcher is still difficult; projected market does not support investor interest and payback**
- **Bantam funds assist, but there are no assurances that long term funding will be available**
 - Random unfocused technology funding does not create a low cost launch capability in the next few years
 - Support such as Space Act Agreement (facilities/labor or range cost credits for demonstration/flights) may move the effort forward, but does little to recoup financing